

Department of Land Records and Agriculture, Bombay.**Second Note on the Potato Disease prevalent in the Poona District and in other parts of India.**

The experiments of 1892-93 are described in detail in Mr. Mollison's note, which is appended. The methods and results of cultivation are there fully described, and in this memorandum only the general inferences to be deduced need be dealt with.

2. Last year's note elicited a good deal of enquiry, and among other facts of interest it was ascertained that the "bangdi" or ring disease was much more widely spread than was at first known. It has established itself throughout the Bombay Presidency including Gujarat, and has been found in the Nilgiris, at Bangalore, and in Bengal. There can be no doubt that preventive measures should be adopted without delay wherever the disease has made its appearance, and fortunately the results of the present experiments are encouraging as regards the practical steps to be taken.

3. Among other communications received from correspondents, some useful information was obtained from Mr. DeJoss, Superintendent at Panchgani, through the Collector of Satara. Mr. DeJoss found that burning the soil with vegetable material, the land having been previously well turned up with the plough and exposed to the sun, was effective to destroy disease-germs, and he succeeded in producing a crop of several varieties which was remarkably free from disease. Three of these were, however, plainly grown from newly imported stocks, and they were planted on the ridge system and not in beds as by native cultivators. Major Radcliffe, Assistant Commissary General at Mhow, wrote recommending the pulling of the haulms and also suggested that the "Magnum Bonum" variety might prove strong enough to resist the disease. We have, however, as shown in Mr. Mollison's note, found other varieties superior to the Magnum Bonum, and the idea of pulling the haulms was based on the assumption that the fungus, as in the European disease, fructifies on the foliage of the plant, which is not the case. But Major Radcliffe's recommendation gains interest from the latest conclusions reached by Dr. Cunningham, which also point to the pulling of the haulms as a preventive measure, though on somewhat different grounds. Mr. Creighton Duff of Coonoor is pursuing a series of experiments with potash and other manures intended to fortify the plant-system against infection.

4. Dr. Cunningham's researches were this season obstructed in some degree by an unexpected difficulty, *viz.*, by the failure of the diseased seed supplied to him for cultivation to reproduce the disease in the crop grown at Calcutta. Probably the diseased potatoes decomposed so far in transport as to lose their power of germination, and only the comparatively healthy ones survived. In any case it must on no account be taken as proved that diseased sets produced a sound crop because they were grown on virgin soil. No conclusion has been more clearly pointed to by the experiments and observations conducted in the field during the past two years than that the disease is propagated from the seed as well as from the soil, and that if anything the first source of infection is the more dangerous and common.

5. On the other hand Dr. Cunningham is inclined to a contrary opinion, microscopical investigation leading him to believe that the lesions in the tuber are of a secondary nature. The primary lesions, he writes, are those in the haulms, and it is the disturbance of nutritive conditions determined by these which occasions the pathological changes in the tuber. He says, "I should certainly be inclined to believe that the disease is maintained not by the use of diseased tubers as such, but as the result of planting either diseased or healthy ones in soil contaminated by containing portions of the haulms with their mycelial and specially their sclerotoid contents." It may be added in this connection that the brownish tinge in the haulm which was noticed last year as a chief diagnostic symptom has this year been much less marked. But although the discolouration has been less striking, following on

an absence of the previously observed tendency to the formation of sclerotoid masses within the larger vessels, it is always discoverable on section, Dr. Cunningham observing that in such preparations "the presence of abundant although generally isolated mycelial filaments comes out very clearly especially within the spiral vessels." In some young plants examined, he found abundant mycelium in the cortical and pith tissues, whereas last year the fungal masses were noticed in the vascular system only. Pulling and burning the haulms might, apparently, tend to save the soil from infection, but it is doubtful whether this can be recommended in practice. The disease develops itself most a little below the soil surface, and extends downwards as well as upwards in the stem. When pulled, the stem breaks off at the main point of disease-development, and as many germs would be left in the soil as would be removed.

6. The practical result of the Khed experiments of the past season is to show that certain varieties of imported seed can and do resist infection in a marked degree. The provisional inferences of last year were against this conclusion, but Mr. Mollison's experimental results have fully established it, and the cultivators of the district are eager to obtain seed for the new stocks at almost any price. Unfortunately it is difficult to keep the cold weather seed till the following winter, because of its tendency to sprout in the monsoon months, and it becomes necessary to grow a crop during the rains to provide seed for the main crop cultivation of the next cold weather. This rain-crop is not always as sound in cultivation as the dry-season produce, and here we find another cause tending to the deterioration of all stocks after they have been grown in this country for any length of time.

7. The "Bouillie Bordelaise" treatment of the land *before sowing* has succeeded in a very considerable degree, and there can be no doubt that flushing diseased land with the copper sulphate solution in the manner adopted in these experiments is specific as regards all disease germs which it reaches. It has been found in large degree to protect sound plants from infection and to prevent the spread of disease from one plant to another. The treatment with caustic lime and soot has been inconclusive because the imported seed proved so robust that the failure of the disease to make headway cannot with certainty be attributed to the treatment adopted.

8. The same somewhat unexpected degree of success with the imported seed has prevented any very clear differentiation being arrived at with respect to the methods of cultivation followed. The ridge and furrow system, however, has not been proved to have the full advantage at first expected. This is probably due to the more rapid growth and maturing of the tubers in this country, the crop being ready in 14—15 weeks as against at least 20 weeks in Europe. The bed system with its superabundance of surface moisture seems to enable the plant to effect the more rapid assimilation of food necessary under Indian conditions. But, on the other hand, it is extremely probable, as pointed out by Mr. Mollison, that the constitution of the plant is unfavorably affected by this luxuriance of growth and is more prone to disease in consequence.

9. The lesson so far learnt is that the disease may be largely checked by the use of the copper salt; but that reliance must chiefly be placed on the distribution of robust seed of the varieties which have been found most successful. It has also been found that the small cut sets used by natives induce weak growth, and that large cut sets or, better still, medium sized potatoes planted whole produce more vigorous seedlings. Great interest has been taken by native cultivators in the experiments, and they have shown themselves ready to take large quantities of seed at prices much over the market rates for the indigenous kind. There is therefore every prospect, at least in the Poona District, of our being now able to effect in the course of a few years a thorough change in the stocks cultivated, but it must be added that there is little prospect of including the raiyats to give their land the needed rest from potato, without which all measures can only be palliative and no permanent cure can be expected.

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Poona, 28th March 1893.

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